

REMARKS

Applicants respectfully request consideration of the amendments and remarks presented herein. Claims 66, 67, 69, 70, 72, 73, 75, 76, 78, 79, 81-85, and 87-90 are pending in the application. Claims 66, 67, 69, 70, 72, 73, 75, 76, 78, 79, 81-85, and 87-90 are rejected. Claims 66, 67, 69, 70, 72, 73, 75, 76, 78, 81-84, and 87-90 are amended herein, and no new matter is added by the amendments herein. Claims 79 and 85 are canceled herein without prejudice. Applicants respectfully submit that claims 66, 67, 69, 70, 72, 73, 75, 76, 78, 81-84, and 87-90 are allowable over the cited prior art and the prior art made of record, as described below, and therefore the rejections have been overcome. Thus, Applicants respectfully request withdrawal of the rejections.

Telephone Conference

Applicants wish to thank Examiner Pham for participating in the telephone conference with Applicants' representative Rick Gregory on December 28, 2005. During the telephone conference the Muraoka and Cabib references were discussed along with claim 66, and no agreement was reached.

Claim Rejections Under 35 USC §103

Claims 66, 67, 69, 70, 72, 73, 75, 76, 78, 79, 81-85, and 87-90 are rejected under 35 USC §103(a) as being unpatentable over Muraoka et al., JP-411220004A (Muraoka), in view of Cabib et al., United States Patent number 5,856,871 (Cabib), and the "ImSpector Imaging Spectrograph" brochure (ImSpector).

Applicants respectfully submit that none of Muraoka, Cabib, or ImSpector nor the combination of Muraoka with Cabib and/or ImSpector describe or teach a system comprising a transfer mechanism operable to transfer a wafer between each of a plurality of stations, an illumination source that illuminates the wafer as the wafer is transferring between the plurality of stations, and a spectral imager configured to detect light of the illumination source that is reflected from the wafer as the transfer mechanism is transferring the wafer between the plurality of stations (underlining herein is emphasis added by Applicants). Reasoning in support of Applicants' position follows.

Applicants agree with the Examiner that Muraoka does not teach that film thickness measurements are made using an imaging spectrometer. Furthermore, Applicants submit that Muraoka discloses a substrate processing apparatus that takes measurements on a stationary wafer at a point between transfer steps. The substrate processing apparatus of Muraoka therefore is used only to transfer a wafer between stations and to hold the wafer stationary while measurements are taken. In contrast, claim 66 as amended includes a spectral imager configured to detect light of the illumination source that is reflected from the wafer as the transfer mechanism is transferring the wafer between stations. Thus, as Muraoka does not disclose making film thickness measurements with a spectral imager, and Muraoka discloses taking measurements only on a stationary wafer, Muraoka does not disclose a spectral imager configured to detect light reflected from the wafer as the transfer mechanism is transferring the wafer between stations. Applicants therefore submit that claim 66 as amended herein is patentable and non-obvious in view of Muraoka.

In further support of Applicants' position that claim 66 is patentable and non-obvious in view of Muraoka, Applicants remind the Examiner that Applicants filed with the US Patent and Trademark Office on March 22, 2005 a certified full English translation of the Muraoka reference. See Translator Certification of J. Marchioro for "A Substrate Processing Apparatus" (Applicants' Exhibit A to the "RESPONSE TO OFFICE ACTION" filed March 22, 2005); and the corresponding English translation of JP-H11220004A to Muraoka (Applicants' Exhibit B to the "RESPONSE TO OFFICE ACTION" filed March 22, 2005 ("Muraoka translation")). After a thorough review of the full translation in the Muraoka translation, Applicants respectfully submit that, contrary to the Examiner's interpretation, Muraoka neither teaches nor suggests making thickness measurements "while the thickness measuring section and the wafer undergo relative motion provided by the wafer transfer mechanism."

With reference to the Muraoka translation, the Abstract of Muraoka makes a very general statement that film thickness measurements "are measured by the measuring part 70 in the process of the transfer of the substrate 9 on the inside of the transfer part 60."

Thus, it is not clear from the Abstract alone whether (1) Muraoka describes taking

measurements while the wafer is in motion, or (2) whether Muraoka describes taking measurements on a stationary wafer at some point in time between wafer transfer steps.

To resolve the ambiguity, we must turn to the translated Muraoka specification. The specification makes it clear that choice (2) is correct, i.e. that Muraoka describes taking measurements on a stationary wafer at some point in time between wafer transfer steps. There is abundant support for this interpretation throughout the specification of the Muraoka translation. For example, paragraph [0020] of the Muraoka translation specifically states that:

“a film thickness measurement part 70 that measures thickness of the film that is formed on the surface of the substrate 9 that is held in place by the transfer robot 61 is further provided in the upper surface of the transfer robot 61.”

Paragraph [0030] of the Muraoka translation makes the same statement more clearly:

“the measurement tip 71 is installed on the transfer part 60 such that it is positioned on the upper surface of the transfer robot 61, and the thickness of the film of the substrate 9 in a state where it is held in place by the transfer robot 61 is measured.”

Paragraph [0045] of the Muraoka translation states that:

“the position control part 84 ... moves the area sensor 73a to a position where it is possible to capture the image of the prescribed area on the substrate 9.”

Furthermore, paragraph [0069] of the Muraoka translation states that:

“the first film thickness measurement part 70a carries out measurements for the unprocessed substrate 9 that it is positioned at the stage immediately after it is removed from the carry-in part 10, and the second film thickness measurement part 70b carries out measurements for the

processed substrate 9 that it is positioned at the stage
immediately before it is housed in the carry-out part 20."

Clearly, by using the transfer robot 61 to hold substrate 9 in place when taking thickness measurements, Muraoka describes a system that takes measurements on a stationary wafer at a point in time between transfer steps, i.e. after the wafer is picked up at one station and before it is dropped off at another station. Thus, Muraoka's transfer mechanism is used only to transfer a wafer between stations, and to hold the wafer stationary when measurements are taken. Unlike claim 66, Muraoka's transfer mechanism is not used to advantage between successive measurements on single wafer, because the motion of relocating the measurement tip 71 is provided by an external mechanism 75. *See* Muraoka translation, paragraph [0033]. In a system according to the claim 66, a single wafer transfer mechanism effects the transfer of a wafer between multiple stations, and relative motion between the wafer and the transfer mechanism to provide acquisition of high-speed thickness measurements as the transfer mechanism is
15 transferring the wafer between stations. *See* Application at p.8, ln.13 to p.9, ln.19.

Consequently, Muraoka fails to teach, and also fails to suggest, at least one element common to all of the claims at issue, namely, detecting light reflected from the wafer as the transfer mechanism is transferring the wafer between stations. Furthermore, the Cabib and ImSpector references also fail to teach or suggest this limitation.
20 Therefore, no combination of Muraoka, Cabib and/or ImSpector disclose, teach, or suggest all elements of the claims at issue. Applications therefore submit that the obviousness rejections cannot be sustained and should therefore be withdrawn.

Applicants further submit that Cabib discloses a method of determining the thickness map of a film overlying a substrate without moving the subject wafer (column 3, lines 40-59). In particular, Cabib teaches determining the thickness map by simultaneously and separately scanning optical path differences generated in the interferometer for each pixel (column 3, lines 31-33 and lines 49-51; column 6, lines 43-45). In order to perform thickness mapping of a stationary wafer, the scanner described in Cabib separately scans optical path differences by scanning the light beam entering the
30 interferometer with respect to the interferometer or scanning the interferometer itself. In so doing the scanner of Cabib scans the optical path difference generated in the light

beam for all the pixels of the scene separately and simultaneously so movement of the wafer is not required. See Cabib, column 4, line 51 through column 5, line 2. Thus, Cabib describes thickness mapping of a stationary wafer by scanning optical path differences of light reflected from the stationary wafer.

5 In contrast to the scanner of Cabib, amended claim 66 includes a spectral imager configured to detect light reflected from the wafer as a transfer mechanism is transferring the wafer between stations. Therefore, as Cabib describes thickness mapping of a stationary wafer by scanning optical path differences of light reflected from the stationary wafer, Cabib does not describe spectral imaging of a wafer as a transfer mechanism is
10 transferring the wafer between stations. Applicants thus submit that claim 66 as amended herein is patentable and non-obvious in view of Cabib.

Regarding Cabib, the Examiner states that "it is well known in the art the scanner (32) can be replaced by a X-Y transfer mechanism so the wafer can be scanned." The Examiner therefore opines it would have been obvious to one having ordinary skill in the
15 art at the time the invention was made to replace the scanner of Cabib by "moving the transfer mechanism of Muraoka because they both are used for the purpose of scanning the wafer."

Applicants contend the teachings of Muraoka and Cabib each demonstrate that any assertion that a transfer mechanism and a scanner are both used for scanning a wafer
20 is incorrect as demonstrated by the skill in the art. Muraoka describes the only function of the transfer part or transfer mechanism as transferring a wafer between stations and holding the wafer stationary when measurements are taken. Muraoka does not include any express teaching that the transfer mechanism can be used "for the purpose of scanning the wafer" and also does not include any language or figure that could be
25 interpreted to mean the transfer mechanism can be used for any purpose other than transferring a wafer and/or holding a wafer stationary.

In contrast to the transfer mechanism of Muraoka, Cabib describes the only function of the scanner as scanning the light beam entering the interferometer or scanning the interferometer itself to scan the optical path difference generated in the light beam.
30 Like Muraoka, Cabib does not include any express teaching or any language or figure that could be interpreted to mean that the scanner can be replaced by a transfer

mechanism or that the scanner can be used for transferring a wafer. Thus, the teaching of Muraoka and Cabib demonstrate that a transfer mechanism and a scanner are separate and distinct components with separate and distinct functions and are not interchangeable because they are not both used for the purpose of scanning a wafer.

5 Applicants further contend there is no motivation to combine Muraoka and Cabib by replacing the scanner of Cabib with the X-Y transfer mechanism so the wafer can be scanned, as the Examiner suggests. The absence of any motivation to combine is clearly supported by the separate and distinct functions of the Muraoka transfer mechanism and the Cabib scanner as described above. The functional differences between the transfer
10 mechanism and the scanner as known in the art and as taught by Muraoka and Cabib support Applicants' contention that there is no motivation to combine because the hypothetical system that would result from this combination teaches away from Cabib.

In addition to the functional differences between a transfer mechanism and a scanner, Applicants now refer the Examiner to several passages in Cabib in further
15 support of their contention that there is no motivation to combine these references because Cabib actually teaches away from systems and methods for transferring or moving a wafer. As one example, Cabib discloses that "there is thus a recognized need for, and it would be highly advantageous to have a method and apparatus for determining the spatial distribution of the thickness of a film overlying a substrate, more quickly, with
20 higher spatial resolution (more test sites), without the need to move the wafer with respect to the measuring instrument when going from a test site to another (higher accuracy, and less wafer handling with the potential for in-situ monitoring) ..." (column 1, lines 56-64). In another passage Cabib also discloses that "the present invention relates to a method and apparatus for mapping film thickness on Silicon wafers or similar
25 substrates, which does not require moving the wafer (making the results faster and spatially more accurate, and potentially capable of being done in-situ)..." (column 1, line 65 to column 2, line 7). In yet another passage Cabib describes "an apparatus for determining the thickness map of a film overlying a substrate ... without wafer movement..." (column 3, lines 40-59). Thus, Applicants contend that there is no
30 motivation to combine Muraoka and Cabib by replacing the scanner of Cabib with the transfer mechanism of Muraoka because Cabib expressly describes a system that includes

a scanner for scanning light reflected from a wafer so as to preclude use of any mechanism that moves the wafer.

In addition to the absence of a motivation to combine these two references, Applicants are of the opinion that replacing the scanner of Cabib with the transfer mechanism of Muraoka would produce a system incapable of functioning to image a wafer. For example, and with reference to Cabib, figure 3, a hypothetical system that directly replaced the scanner (element 32) of Cabib with a transfer mechanism would not function to image a wafer because the transfer mechanism, and consequently the wafer, would be positioned between the optical system (31) and the interferometer. This hypothetical configuration therefore would remove the optical system (31) from the path between the wafer and the interferometer. Without the optical system (31) the hypothetical system would not be able to collect light from the wafer and direct the collected light to the interferometer as required by Cabib (column 5, lines 5-9).

Applicants therefore submit that the system described by Cabib does not support incorporation of the Muraoka transfer mechanism because the combination of the optical system, scanner, and interferometer of the Cabib system is configured only to image a stationary wafer. Consequently, there is no motivation to combine these references because, without any teaching by Cabib or Muraoka as to how to reduce to practice such a hypothetical system having the scanner replaced by a transfer mechanism, undue experimentation would be required to integrate a wafer transfer mechanism into a system so that a system designed to image a stationary wafer could be used for imaging a moving wafer. Applicants therefore respectfully submit that Muraoka in combination with Cabib does not make obvious to one of ordinary skill in the art the invention of claim 66. Accordingly, Applicants respectfully request withdrawal of the rejection under 35 USC §103(a).

As described above, the Examiner states that "it is well known in the art the scanner (32) can be replaced by a X-Y transfer mechanism so the wafer can be scanned" and uses this statement as the support for his opinion that it would have been obvious to one having ordinary skill in the art at the time the invention was made to replace the scanner of Cabib by "moving the transfer mechanism of Muraoka because they both are used for the purpose of scanning the wafer." In objecting to the Examiner's assertion that

it would have been obvious to one having ordinary skill in the art to replace the scanner of Cabib with the transfer mechanism of Muraoka because it is well known in the art the scanner can be replaced by a transfer mechanism so the wafer can be scanned. Applicants submit that one of ordinary skill in the art would not be able to effect, without undue experimentation, replacement of the scanner with a transfer mechanism to produce a system that would yield desirable results. In support of Applicant's objection to the Examiner's position, Applicants submit that the level of ordinary skill in the art as to replacing a wafer scanner with a wafer transfer mechanism in order to image a wafer as a transfer mechanism is transferring the wafer is not disclosed and/or represented by Muraoka, Cabib, and/or any other reference cited by the Examiner. If it can be argued that Muraoka and Cabib represent the level of ordinary skill in the art as to film thickness measurement, that level of ordinary skill in the art as to film thickness measurement is measuring a stationary wafer as disclosed and/or represented by Muraoka or Cabib.

Furthermore, the Examiner has not provided citation to any reference in support of his opinion that it is well known in the art to replace a wafer scanner with a wafer transfer mechanism. Applicants therefore submit that, because the Examiner does not specifically cite any prior art references in support of his opinion on replacing a scanner with a transfer mechanism, the level of ordinary skill in the art with regard to replacing a scanner with a transfer mechanism should not be presumed to be represented by the Examiner's opinion and/or Muraoka and Cabib. Applicants also respectfully remind the Examiner that he must rely, at least to some extent, on a reference for describing what is well known in the art. As each of Muraoka and Cabib disclose only imaging of stationary wafers, Muraoka and/or Cabib cannot be relied upon as a reference for describing what is well known in the art or the level of ordinary skill with regard to imaging wafers as a transfer mechanism is transferring the wafer.

Applicants respectfully acknowledge that an obviousness rejection may be based on an Examiner's personal knowledge, if the Examiner asserts that his position stated in the Office Action is based on his personal knowledge. However, 37 C.F.R. §1.104(d)(2) states that "when a rejection in an application is based on facts within the personal knowledge of an employee of the Office, the data shall be as specific as possible, and the reference must be supported, when called for by the applicant, by the affidavit of such

employee, and such affidavit shall be subject to contradiction or explanation by the affidavits of the applicant and other persons" (Title 37, Volume 1, revised as of July 1, 2004). Thus, if the Examiner is basing his position of the present Office Action, and therefore this rejection, on personal knowledge, Applicants herein challenge and object to this rejection and request of the Examiner an affidavit under 37 C.F.R. §1.104(d)(2) with respect to any part of this rejection based wholly or partly on the Examiner's personal knowledge.

Applicants further submit that as the Examiner does not provide specific reasons to support his obviousness rejection based on his opinion that it is well known in the art to replace a scanner with a transfer mechanism, but instead offers only his position, he has failed to establish a prima facie case of obviousness.

Thus, considering all the above-stated remarks, Muraoka, Cabib, and/or ImSpector do not disclose the invention of claim 66, and claim 66 is patentable over Muraoka, Cabib, and/or ImSpector. Further, as claim 67 depends from claim 66, claim 67 is also patentable over Muraoka, Cabib, and/or ImSpector. Accordingly, Applicants respectfully request withdrawal of the rejection of claims 66 and 67 under 35 USC §103(a).

Applicants further submit that claims 69, 70, 72, 73, 75, 76, 78, 81-84, and 87-90, as amended herein, are patentable over Muraoka, Cabib, and/or ImSpector for the reasons stated above with reference to claim 66. Thus, Applicants respectfully request withdrawal of the rejection of claims 69, 70, 72, 73, 75, 76, 78, 81-84, and 87-90 under 35 USC §103(a).

Conclusion

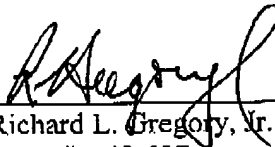
In view of the foregoing remarks, Applicants respectfully submit that claims 66, 67, 69, 70, 72, 73, 75, 76, 78, 81-84, and 87-90 are in condition for allowance. Thus, allowance of the claims is requested. If there are any issues that remain to be resolved prior to allowance of the claims or, in the opinion of Examiner Pham, a telephone conference would expedite the prosecution of the subject application, Examiner Pham is encouraged to call Rick Gregory at (408) 342-1900.

A Petition for Extension of Time Under 37 CFR 1.136(a) is enclosed herewith for

a three (3) month extension of time.

Respectfully submitted,
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